

CLAIMS:

1. A knuckle boom apparatus, comprising:
 - a machine base;
 - a hoist boom having a proximal end pivoted to the machine base, and a distal end remote therefrom;
 - a stick boom having an intermediate pivot pinned to pivot on the distal end of the hoist boom, a distal end configured to carry a working tool and a proximal end having a suitable cylinder push point;
 - at least one hydraulic hoist cylinder mounted between said machine base and said hoist boom;
 - at least one hydraulic stick cylinder mounted between said hoist boom and said stick boom;
 - a hydraulic reach cylinder mounted above said hoist boom between said hoist boom and said suitable push point at said stick boom proximal end, whereby when said hydraulic reach cylinder is actuated by supplying oil to its base end, said distal end of said stick boom is withdrawn towards said machine base; and
 - a hydraulic circuit for operatively supplying hydraulic oil to said hoist, stick and reach cylinders, wherein said hydraulic circuit comprises at least one hydraulic conduit line connecting respective base end ports of said hoist and stick cylinders so as to allow hydraulic oil to shunt between base ends of said hoist and stick cylinders.

2. A knuckle boom apparatus, comprising:
 - a machine base;
 - a hoist boom having a proximal end pivoted to the machine base, and a distal end remote therefrom;
 - a stick boom having a proximal end and a distal end configured to carry a working tool, and an intermediate pivot where it is pinned to the distal end of said hoist boom;
 - a hydraulic hoist cylinder mounted beneath said hoist boom and pinned between said machine base and said hoist boom to stroke between said hoist boom and said machine base;
 - a first stick-located hydraulic cylinder mounted beneath said hoist boom said stick boom and pinned between said hoist boom and said stick boom to stroke between said hoist boom and said stick boom;

a second stick-located hydraulic cylinder mounted above said hoist boom and pinned between said hoist boom and said proximal end of said stick boom to operate the angle between said hoist boom and said stick boom; and

a hydraulic circuit with at least first and second directional control valves for operatively supplying hydraulic oil to said cylinders;

wherein a base end hydraulic port of said first stick-located hydraulic cylinder is connected via hydraulic conduit to the base end hydraulic port of said hoist cylinder, and said so-connected base end ports are connected via hydraulic conduit to a work port of said first directional valve;

wherein the second of said stick-located cylinders is connected via hydraulic conduit to said second directional valve to operate as a reach cylinder, whereby a manual operation of only said second directional valve causes all said cylinders to stroke simultaneously and said stick boom distal end to move in a desired near-horizontal path; and

wherein said stick boom distal end moves towards said machine base when said second directional control valve supplies oil to the base end of said second stick-located hydraulic cylinder.

3. A knuckle boom apparatus as in claim 2, wherein the second stick located hydraulic cylinder is double rod ended and is trunnion mounted at its base end to the top of the hoist boom.

4. A knuckle boom apparatus as in claim 3, wherein both rods are of the same diameter.

5. A knuckle boom apparatus, comprising:

a machine base;

a hoist boom having a proximal end pivoted to the machine base, and a distal end remote therefrom;

a stick boom having an intermediate pivot pinned to pivot on the distal end of the hoist boom, and a distal end configured to carry a working tool and a proximal end having a suitable cylinder push point;

at least one hydraulic hoist cylinder mounted between said machine base and said hoist boom;

at least one hydraulic stick cylinder mounted between said hoist boom and said stick boom;

a double rod ended hydraulic reach cylinder trunnion mounted between said hoist boom and said suitable push point at said stick boom proximal end, wherein said reach cylinder has base end and rod end piston areas that are both net of rod areas; and

a hydraulic circuit for operatively supplying hydraulic oil to said cylinders, wherein said hydraulic circuit comprises at least one hydraulic conduit line connecting respective base end ports of said hoist and stick cylinders so as to allow hydraulic oil to shunt between base ends of said hoist and stick cylinders;

wherein said reach cylinder is located above said hoist boom so that when said circuit supplies oil to said reach cylinder at its base end said distal end of said stick boom is withdrawn towards said machine base.

6. A knuckle boom apparatus as in claim 5, wherein both rods are of the same diameter.

7. A knuckle boom apparatus, comprising:

a machine base;

a hoist boom having a proximal end pivoted to the machine base, and a distal end remote therefrom;

a stick boom having a proximal end and a distal end configured to carry a working tool, and an intermediate pivot where it is pinned to the distal end of said hoist boom;

a hydraulic hoist cylinder mounted beneath said hoist boom and pinned between said machine base and said hoist boom to stroke between said hoist boom and said machine base;

a first stick-located hydraulic cylinder mounted beneath said hoist boom and said stick boom and pinned between said hoist boom and said stick boom to stroke between said hoist boom and said stick boom;

a second stick-located hydraulic cylinder, mounted beneath said boom and pinned between said hoist boom and said stick boom to operate the angle between said hoist boom and said stick boom; and

a third stick-located hydraulic cylinder mounted above said hoist boom and pinned between said hoist boom and said proximal end of said stick boom to assist said second stick-located cylinder to operate the angle between said hoist boom and said stick boom; and

a hydraulic circuit with at least first and second directional control valves for operatively supplying hydraulic oil to said cylinders;

wherein a base end hydraulic port of said first stick-located hydraulic cylinder is connected via hydraulic conduit to the base end hydraulic port of said hoist cylinder; said so-connected base end ports are connected via hydraulic conduit to a work port of said first directional valve;

wherein a work port of said second directional valve is connected via hydraulic conduit to the base end port of said second stick-located cylinder so that it will operate as a reach cylinder;

wherein the same work port of said second directional valve is also connected via hydraulic conduit to the rod end port of said third stick-located hydraulic cylinder to cause it to assist in acting as a reach cylinder with motion in the same direction of reach as said second stick-located cylinder;

whereby a manual operation of only said second directional valve causes all said cylinders to stroke simultaneously and said stick boom distal end to move in a desired near-horizontal path;

and wherein said stick boom distal end reaches outward from said machine base when said second directional control valve supplies oil to the base end of said second stick-located hydraulic cylinder and to the rod end of said third stick-located hydraulic cylinder.

8. A knuckle boom apparatus, comprising:

a machine base;

a hoist boom having a proximal end pivoted to the machine base, and a distal end remote therefrom;

a stick boom having an intermediate pivot pinned to pivot on the distal end of the hoist boom, and a distal end configured to carry a working tool and a proximal end having a suitable cylinder push point;

at least one hydraulic hoist cylinder mounted beneath said machine base and said hoist boom;

at least one hydraulic stick cylinder mounted between said hoist boom and said stick boom;

a first hydraulic reach cylinder mounted beneath said hoist and stick booms and pinned to operate the angle between said hoist and stick booms;

a second hydraulic reach cylinder, mounted to and above said hoist boom and connected to said push point at said stick boom proximal end and also pinned to operated the angle between said hoist and stick booms; and

a hydraulic circuit for operatively supplying hydraulic oil to said cylinders, wherein said hydraulic circuit comprises at least one hydraulic conduit line

connecting respective base end ports of said hoist and stick cylinders so as to allow hydraulic oil to shunt between base ends of said hoist and stick cylinders;

wherein when said circuit simultaneously supplies oil to said second reach cylinder at its base end and said first reach cylinder at its rod end, said distal end of said stick boom is withdrawn in a suitable near-horizontal path towards said machine base; and

wherein when said circuit simultaneously supplies oil to said first reach cylinder at its base end and said second reach cylinder at its rod end, said distal end of said stick boom is advanced in a suitable near-horizontal path away from said machine base.